

**UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF MICHIGAN
SOUTHERN DIVISION**

3D SYSTEMS, INC.,

Plaintiff,

V.

ENVISIONTEC, INC., ENVISIONTEC GMBH,
and SIBCO, INC.,

Defendants.

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Case No. 2:05-cv-74891

Hon. Avern Cohn
Magistrate Judge R. Steven Whalen

**DECLARATION OF DR. PAUL F. JACOBS
IN OPPOSITION TO PLAINTIFF'S MOTION FOR SUMMARY JUDGMENT OF
INFRINGEMENT AND IN FURTHER SUPPORT OF DEFENDANTS' MOTION FOR
SUMMARY JUDGMENT OF NON-INFRINGEMENT**

I, Dr. Paul F. Jacobs, submit this Declaration in opposition to Plaintiff's Motion for Summary Judgment of Infringement and in support of Defendants' Motion for Summary Judgment of Non-Infringement. The facts set forth below are based on my personal knowledge, and if called to testify, I could and would testify competently thereto.

1. I was the Director of Research & Development for 3D Systems, Inc. from 1989 until 1997. During that time, I directed research with respect to the fundamentals of the stereolithography process and also helped developed numerous important commercial applications. I am also the author of the first book in the field: "Rapid Prototyping & Manufacturing: Fundamentals of Stereolithography" which was published by SME in 1992. Subsequently I authored another volume: "Stereolithography and Other RP&M Technologies" that was published jointly by SME and McGraw-Hill in 1996. I have written over 130 publications and have been a teacher at UCLA, Princeton University, Clemson University, and Worcester Polytechnic Institute. I am a named inventor on 21 United States patents.

2. Based upon my study and analysis it is my opinion that the Perfactory and Vanquish machines of Envisiontec do not infringe any claim of the '981, '537, '143, and '934 patents.

3. I incorporate in its entirety my earlier Declaration in Support of Defendants' Motion for Summary Judgment of Non-Infringement. As set forth therein, it is my opinion that the accused Perfactory and Vanquish machines do not infringe claim 11 of U.S. Patent No. 5,630,981 (the '981 patent); claim 81 of U.S. Patent No. 5,902,537 (the '537 patent); claim 35 of U.S. Patent No. 4,999,143 (the '143 patent); or claim 2 of U.S. Patent No. 5,651,934 (the '934 patent).

4. A fundamental component of the stereolithography apparatus is the use of a recoater. The patents at issue specifically use a blade to recoat photopolymer resin in order to form a substantially uniform layer to be cured by ultraviolet laser radiation. According to one of the patent claims at issue, the recoater blade is “winged”. It is important to understand that all SLA systems use some sort of recoater blade that actively moves or deposits photopolymer resin and has at its core purpose a rheological function to generate a reasonably uniform resin layer. As admitted to by Dr. Stucker, the Perfactory does not use any recoating system whatsoever. Further, while the Vanquish does have a cooling element that intermittently moves across the active resin working area (i.e., not necessarily subsequent to each exposure step), the cooling element’s purpose is solely to remove excess heat which is a natural consequence of the exothermic nature of the photopolymer interaction with actinic radiation. My point is that the stereolithography process that is disclosed in the patents at issue must use an active recoater system whose function is purely rheological (i.e., moving and smoothing a relatively viscous liquid). Conversely, the Perfactory uses no such device and the Vanquish uses an intermittently moving cooling element purely for thermodynamic reasons and not for rheological reasons.

5. Another fundamental point of distinction between the patents at issue and the accused products of Envisiontec relates to the claim term “layer” or “layers”. The reason for this fundamental difference has to do with the physics of the propagation of actinic radiation in a photopolymer. In the stereolithography apparatus (SLA) that is disclosed in the patents at issue, one must achieve enough cure depth to assure adhesion to the previous layer, thereby avoiding layer delamination, while not excessively curing, which can cause part distortion. Consequently, the concept of a “layer” is absolutely fundamental to the stereolithography process that is disclosed in the patents at issue. The layers also need to be substantially uniform. If the layers

are not substantially uniform, the result can be either (a) layer delamination if the resin layer thickness happens to exceed the total cure depth, or (b) excessive part distortion if the layer is substantially thinner than the total cure depth.

6. For both the Perfactory and Vanquish machines, which are based on a voxel curing concept, i.e., voxelization, it is not necessary to have layers at all. In fact, as I have stated previously, the Perfactory and Vanquish systems do not technically produce layers. For example, in the SLA that is disclosed in the patents at issue, one might have a nominal layer thickness of “a”. If a part has a height in one portion that is, for example, 179a, and another portion which is 527a, and another portion which is 714.6a, the SLA that is disclosed in the patents at issue, will build 179 layers for the first portion and 527 layers for the second portion. However, there is a problem with the third portion because the SLA that is disclosed in the patents at issue must direct the software to build either 714 layers or 715 layers for the third portion. If it builds 714 layers, that portion of the part will be too short by a 0.6a layer thickness. If it builds 715 layers, that portion of the part will be too tall by a 0.4a layer thickness. With either the Perfactory or Vanquish, the exposure of the actinic radiation for the voxels corresponding to the third portion of the part are automatically adjusted three dimensionally to create the correct curing volumes. Further, it is my understanding that there are many part geometries that have been made by the Perfactory or Vanquish where the voxel curing depths are different and independent from each other and can even exceed the maximum set curing depth. For these reasons, the voxelization process used in both the Perfactory and Vanquish machines does not generate layers in the normal sense, and certainly not substantially uniform layers as those terms are defined by the disclosures of the patents at issue. I therefore disagree with Dr. Stucker’s characterizations of layers for the reasons set forth previously.

7. Another fundamental difference between the SLA that is disclosed in the patents at issue and the Perfactory/Vanquish machines relates to the process by which “successive layers” are formed. In the SLA that is disclosed in the patents at issue, the first layer is formed over supports attached to a platform with photopolymer resin being swept, pushed, or deposited by a recoater as discussed previously. In the Perfactory, the irradiation takes place through a transparent “basement” which allows the voxel volumes to be cured. Tipping of the basement effects a release of the newly cured voxels from the resin substrate. By developing this “release” approach, Envisiontec has eliminated the need for any recoater since the photopolymer for the next voxels move into position based upon gravity. In the continuous build process of the Vanquish, a recoater blade is also unnecessary since each voxel region is cured after the uncured resin moves by gravity in response to downward basement movement.

8. As I have described previously, a collection of three dimensional voxels, where each of the voxels has its own z-dimension analogous to a city skyline, cannot be called a “layer”. Dr. Stucker alleges that the three dimensional voxel matrix generated by the DLP is the same as laser drawing. This is not correct. Each of the simultaneously formed three dimensional voxels contains information about the third or z-dimension which is unique for every voxel. Thus, the voxelization process cannot form “layers”, and the process does not involve “drawing” in the normal sense of that word.

9. I agree with Dr. Stucker’s characterization that the ‘981 patent is directed to stereolithography in general; the ‘934 patent relates to the use of a smoothing element used to form a level coating over each previously solidified object layer; the ‘537 patent relates to the use of an applicator connected to a vacuum pump to recoat fresh curable liquid over each previously solidified object layer; and the ‘143 patent concerns the formation of removable

supports for the object. Dr. Stucker also describes Figure 3 of the '981 patent as showing a light source 26 which "produces a spot 27 of light small enough to allow the desired object detail to be formed, and intense enough to cure the curable liquid being used quickly enough to be practical. The light source 26 is arranged so it can be programmed to be turned off and on, and to move such that the focus spot 27 moves across the surface 23 of the liquid 22". The Perfactory and Vanquish, however, have no spot light used to cure the resin.

10. Dr. Stucker states that in the '981 patent, the embodiment shown in Figure 4 shines the light source 26 at the interface between the liquid 22 and a non-miscible and transparent liquid 32 on which the liquid 22 floats. As the liquid 22 solidifies layer by layer, the object is built from the bottom down such that each successive layer is formed beneath or under a previously solidified layer. However, neither the Perfactory or Vanquish use any physical aperture mask and there are no constant cross-sectional shapes in either the Perfactory or Vanquish processes.

11. Dr. Stucker refers to Figure 5 of the '981 patent as disclosing a collimated UV light source 35 and suitable apertured mask. Neither the Perfactory or Vanquish use collimated UV light sources and neither the Perfactory or Vanquish use apertured masks.

12. Dr. Stucker refers to the Figure 6 embodiment of the '981 patent relating to a CRT. Again, the Perfactory and Vanquish machines do not have masks or a web of masks and no mask movement is done or performed in the operation of the Perfactory and Vanquish processes.

13. Dr. Stucker describes and discloses the meaning of "winged blade". It is obvious to me from his definition and illustrations, that neither the Perfactory or Vanquish have any "winged blade" design.

14. Dr. Stucker describes the use of “webs” and the definition of “webs”. The Perfactory and Vanquish do not use web structures. Teeth are used. As described previously, these teeth are not solid. Further, to the extent that Dr. Stucker believes that the “barriers” that may be formed in the Vanquish process are the same as “supports”, I disagree. First, they are perforated, and not solid. Significantly, they serve a totally different purpose. Due to the continuous movement of the basement platform during the process, transverse shear in the resin is caused only by the intermittent passing of the cooling element. The barriers are designed to minimize floating in the critical areas to prevent newly formed voxel elements from being carried away. This means that during the majority of the build time, they are not even attached to the elements that they are protecting.

15. It should be noted that a CAD generator computer is necessary to export an STL file. Further, a CAD file is not an STL file. An STL file is data that approximates a three-dimensional object, and it is not possible to go back from a STL file to a CAD file and have the exact original CAD data if you wish to make changes accurately to the original design.

16. I disagree with the characterization of the operation of the Perfactory machine which is stated by Dr. Stucker. As discussed previously, the part is not built on a layer by layer basis in the Perfactory or Vanquish machines. Further, with respect to the Perfactory machine, the purpose of the tilting mechanism is to allow for flow of resin from one side to another to make sure that the material is mixed and is not overheating. Gravity results in material flowing. The tilting mechanism is not solely for the purpose of separating.

17. I disagree with the characterization of the cooling element by Dr. Stucker. The movement of the cooling element is not performed after every exposure. It is intermittent and is done when the exposure surface generates a substantial amount of heat. Further, based on Dr.

Stucker's own definition and illustrations, the cooling element is clearly not a "wing" shaped blade.

18. The software for the Perfactory and Vanquish machines provides a three dimensional matrix of intensity values before the part is even built. These intensity values are correlated to the three dimensional interference of the voxels with the part. In addition, CAD data or its equivalent is not provided. Instead, STL data is provided which requires a computer with a translator from a specific CAD design software on the computer to the STL format. Every CAD software has a unique format and must have an STL translator that is capable of reading that format and then translating it into an STL file.

19. As described previously, in the Perfactory and Vanquish machines, the data is provided in individually unique voxels corresponding to individual mirrors on the DLP. It is definitely not provided as an individual layer. The voxel information is a batch of individual three dimensional points of data which are independent of each other. It is my understanding that it is possible to increase the depth of curing of any individual voxel beyond the nominal maximum voxel depth by exposing the individual voxel to a maximum voxel depth and then increasing the exposure time for that specific voxel thereby increasing the depth of cure beyond the nominal maximum voxel depth.

20. Dr. Stucker alleges that the Perfactory and Vanquish machines generate data representing adjacent cross-sectional layers to form an object. He is incorrect for the reasons stated previously. There is no inter-relationship between the individual three dimensional voxels used in the Perfactory and Vanquish machines. Further, these systems do not in any way generate data representing adjacent cross-sectional layers to form the object.

21. I also do not agree with Dr. Stucker's allegations that even if the judge or jury were to conclude that this element, i.e., data representing adjacent cross-sectional layers, was not literally present in the Perfactory and Vanquish machines, that element is met under the doctrine of equivalents. There can be no equivalence between an approach which is based upon two dimensional slice data, i.e., the patents in issue, and an approach that is based upon a three dimensional collection of individual voxels with varying intensity values.

22. Dr. Stucker has also incorrectly described the process for the Vanquish. He refers to wedge-like sections based upon the testimony of Mr. Shkolnik. However, Mr. Shkolnik testified that the wedge in his simulation was there for the purpose of representing a frozen moment in time which is not static, in fact, since the material is constantly moving. In my opinion, continuous motion is fundamentally different from intermittent motion with static pauses, and thus, Dr. Stucker cannot use the animation or testimony of Mr. Shkolnik to argue for cross-sectional layers in the Perfactory and Vanquish machines.

23. Dr. Stucker also argues again from the embodiment of the '981 patent shown in Figure 5, that using a moveable UV light source with an apertured mask and a focused spot is equivalent to the process used in the Perfactory and Vanquish machines. In my opinion, there is no scientific support for Dr. Stucker's argument on equivalence for the reasons that I have previously stated.

24. Dr. Stucker refers to non-stereolithography patents for alleging the equivalence between a belt translation and a lead screw translation. However, the issue is not whether a belt can be used instead of a screw for purposes of moving the cooling element in the Vanquish machine. In the Vanquish machines, the belt system was intentionally used to prevent vibration from occurring since it is not desirable for the cooling blade to engage the active resin surface

when the heat is being removed by the cooling blade. In my opinion, any equivalence between a belt and screw in the stereolithographic environment claimed by the patents in issue is irrelevant since they are not being used for similar purposes.

25. I disagree with Dr. Stucker's characterization of the supports for the Perfactory and Vanquish machines. The use of teeth and perforated supports in the Perfactory and Vanquish machines reduces material consumption and allows for faster building since less heat is generated because fewer voxel volumes are being cured. For the reasons previously stated, the supports used in the Perfactory and Vanquish are not the same as or even equivalent to the solid supports disclosed in the patents at issue.

26. I disagree with the statements made by Dr. Stucker regarding the Magics software. It is my understanding that the Magics software includes a platform file which contains all the parameters that will generate the specific type of structures required to build the parts on the machines. It is also my understanding that a web support is not used when installing the platform file. Again, the use of perforated supports with teeth in the Perfactory and Vanquish machines is very different than the solid supports which are claimed and disclosed in the patents at issue.

27. The Perfactory and Vanquish machines do not draw an image. Drawing cannot be performed without moving on a two dimensional surface. The Perfactory and Vanquish machines project millions of individual points in a three dimensional manner at different points in time with individual intensities and cure depth that can be above and/or below the nominal maximum voxel cure depth.

28. It is also not possible to create a static uniform coating with the continuous motion of the basement platform in the Vanquish since the movement of the resin is continuous.

As set forth previously, the wedge in Mr. Shkolnik's animation is strictly for simulation purposes and only provides a representation of a frozen moment in time. Since there is not a moment in time that the material is not moving in the Vanquish, it is not possible to create a static uniform coating.

29. It should also be noted that there are several factors contributing to the reasons why the Perfactory and Vanquish do not create layers or smooth layers. One of the reasons is the voxel curing depth, but other factors include resin viscosity, the amount of heat generated during the exothermic reaction of curing, and the number of voxels with nominal maximum intensity. These are only some of the reasons that provide further support for the differences between the Perfactory and Vanquish process and the process disclosed in the patents at issue.

30. Parts manufactured by the SLA technology in the patents at issue are layered based and will show layering in the Z-direction. Parts manufactured by the voxelization process, however, are not layered. The three dimensional intensity field provided by voxelization contains the real three dimensional interference of the part with the voxels. The patents at issue, on the other hand, disclose slicing of data for creating layers that contain two dimensional cross-sectional information. Thus, as discussed previously, the three dimensional voxelization process used for the Perfactory and Vanquish machines is fundamentally different from the two dimensional slicing of data approach disclosed and claimed in the patents at issue.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Executed on this, the 19th day of December, 2008.


Dr. Paul F. Jacobs

CERTIFICATE OF SERVICE

I hereby certify that on December 22, 2008, I electronically filed the foregoing paper with the Clerk of the Court using the ECF system which will send notification of such filing to the following: Jonathan A. David, Susan M. Kornfield and Alan N. Harris.

s/R. Terrance Rader

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